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(54) Method of producing sand metal casting mold, by a plurality of alternate sand supply and vibration steps

(57) Dry molding sand is supplied to a molding box 2 to partially fill it. The molding box 2 is then vibrated to compact the sand 8 around the pattern 6. The supplying of sand and the vibrating of the molding box are repeated alternately until the molding box is filled with sand compacted around the pattern. The method avoids prior art difficulties in which single successions supply and vibration steps involving mainly vertical vibration, causes a single and large sinking of the sand around the pattern, causing damage to horizontally projecting arms of the pattern, or bending of the pattern when it is of asymmetric shape.

FIG.1

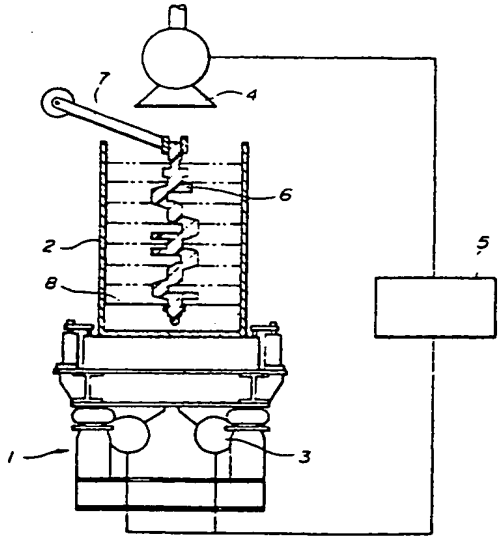

FIG.2

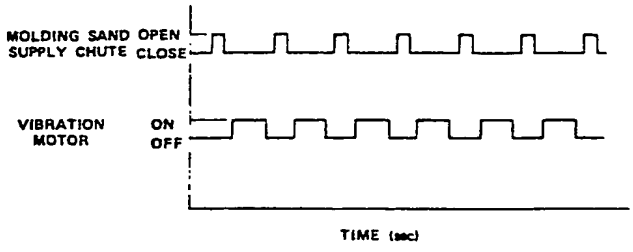

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FIG.1

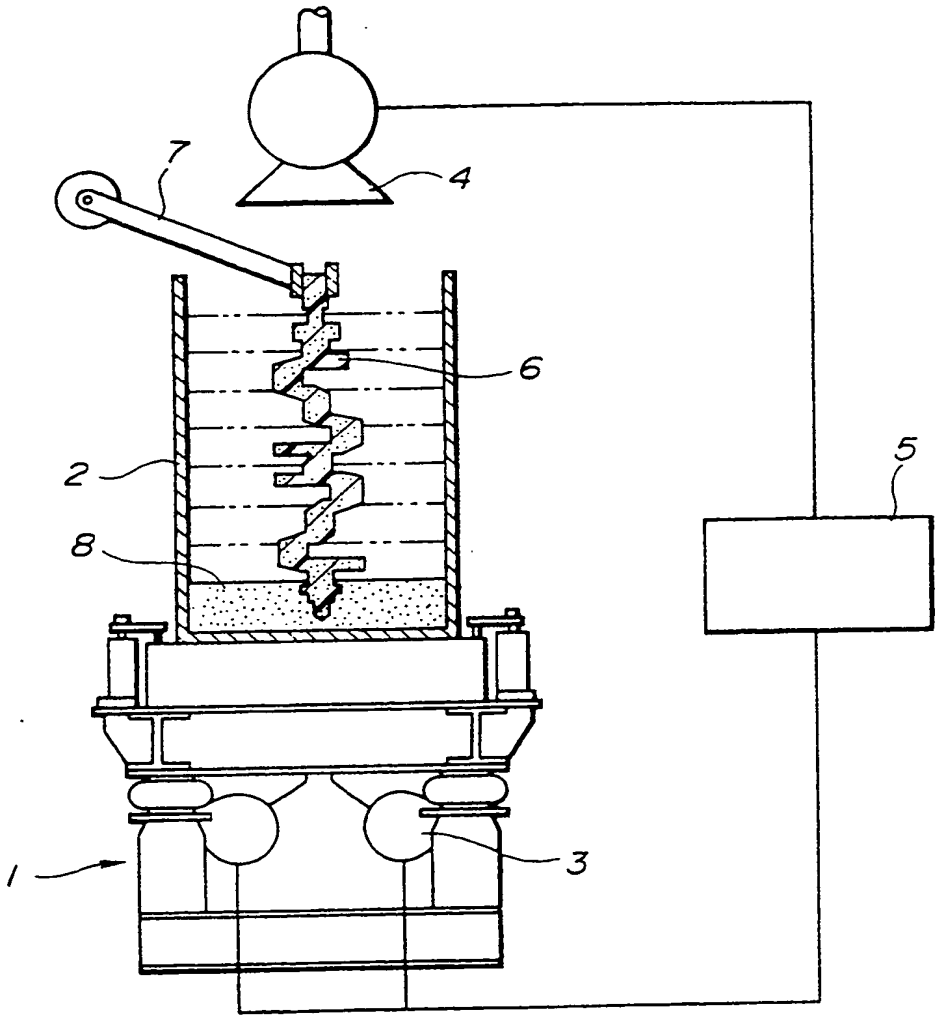

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FIG.2

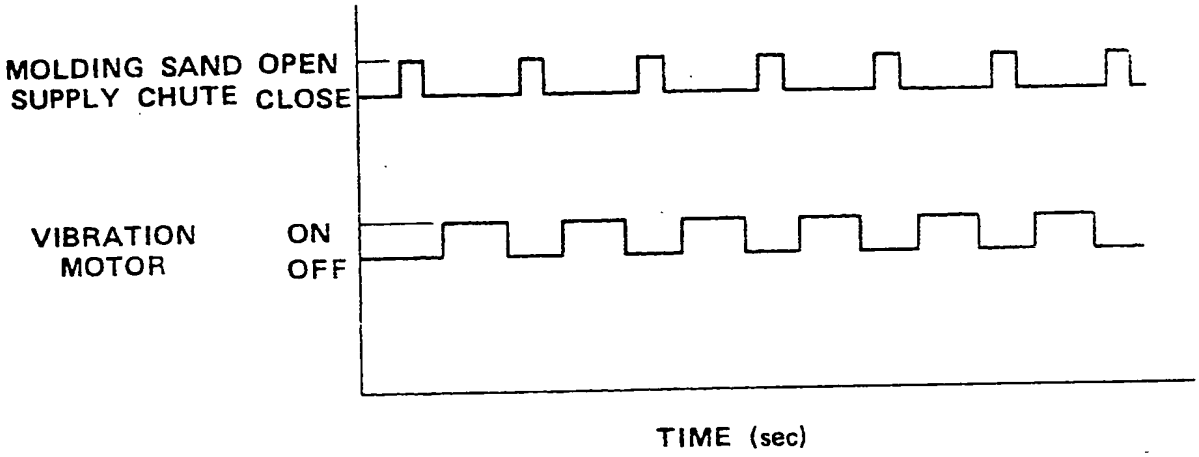


FIG.3

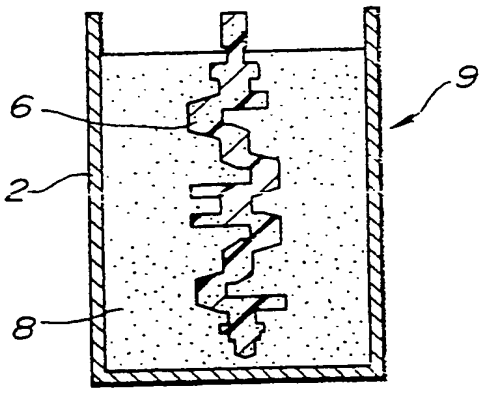
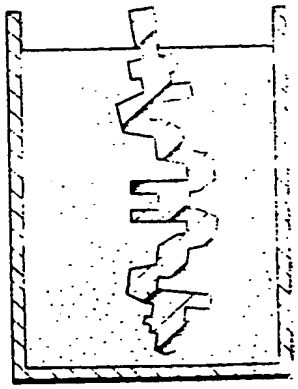


FIG.4
(Prior Art)



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METHOD OF PRODUCING MOLD FOR FULL MOLD PROCESS

The present invention relates to a method of producing a mold for a full mold process.

A prior art mold for a full mold process is produced by first disposing a pattern within a molding box, filling the molding box with dry molding sand all at once, and vibrating the molding box mainly vertically for thereby compacting the dry molding sand around the pattern.

In such a prior method, the higher the green molding sand is located within the molding box, the more it sinks. Due to this, when the pattern has a protruded portion directed to intersect the vertical axis of the molding box, the protruded portion is liable to be damaged severely by the sinking dry molding sand. This is particularly true when the protruded portion is located in a higher position within the molding box.

When the pattern is asymmetrical about a longitudinal axis or an axis transverse thereto, the portions of the pattern divided by the axis of asymmetry receives different forces from the dry molding sand. For example, if the pattern has an external surface including complexly protruded and recessed portions, the dry molding sand is caused to flow in various directions depending on the configuation of the pattern, thus the forces acting on the pattern varying from place to place and therefore causing the pattern to bend largely as

shown in Fig. 4.

In accordance with the present invention, there is provided a novel method of producing a mold for a full mold process.

The method comprises disposing a pattern within a molding box, supplying dry molding sand into the molding box dividedly, and vibrating the molding box at each divided supply of the green molding sand.

In another form of the invention, the method comprises disposing a pattern within a molding box, supplying a portion of dry molding sand into the molding box, vibrating the molding box to compact the portion of dry molding sand around the pattern, and repeating the supplying and the vibrating alternately until the molding box is filled with the dry molding sand.

In a further form of the invention, the above described supplying comprising determining an amount of dry molding sand in view of the shape and the size of the pattern so that the amount of movement of the dry molding sand during the above described vibrating is smaller than a predetermined value.

The above is quite effective for solving the above noted problems inherent in the prior art method.

It is accordingly possible to provide a mold for a full mold process which does not cause any damage to a pattern during compacting of dry molding sand even when the pattern has a complexly protruded and recessed configuration.

Such a method does not cause the pattern to be bent after the compacting of dry molding sand even when the pattern has a complexly protruded and recessed configuration.

The invention thus provides a method of producing a mold for a full mold process which can reduce the amount of sinking or movement of dry molding sand during the compacting.

In the accompanying drawings:

Fig. 1 is a schematic view of a device for practising a method of this invention;

Fig. 2 is a timing diagram of operations of a vibration motor and a molding sand supply chute;

Fig. 3 is a sectional view of a mold produced by the method of this invention; and

Fig. 4 is a view simialr to Fig. 3 but showing a mold produced by a prior art method.

Referring now to the drawings, the present invention will be described by way of example.

Fig. 1 shows a device for practising the method of this invention. In Fig. 1, indicated by the reference numeral 1 is a vibration table, by 2 is a molding box installed on the vibration table 1, by 3 is a vibration motor for applying vibrations to the molding box 2 installed on the vibration table 1, by 4 is a molding sand supply chute for supplying green molding sand into the molding box 2, and by 5 is a control means for controlling the operation of the vibration motor 3 and the molding sand supply

chute 4. The pattern 6 is made of, for example, polystyrene foam and is adapted to be replaced by molten metal when molten metal is poured into the mold to cause the pattern 6 to burn up.

According to the present invention, the pattern 6, which is supported at its upper end upon a support arm 7, is disposed within the molding box 2 installed on the vibration table 1. After that, under the control of the control means 5, the molding sand supply chute 4 is opened to perform a first supply of dry molding sand 8 into the molding box 2. Then, under the control of the control means 5, the molding sand supply chute 4 is closed to stop the supply and opened to perform the supply alternately, whilst the vibration motor 3 is turned on to vibrate the molding box 2 and turned off to stop vibrating the molding box 2 alternately as shown in Fig. 2.

More specifically, after the dry molding sand 8 of the first supply is compacted around the pattern 6, the molding sand supply chute 4 performs a second supply of dry molding sand 8 which is compacted around the pattern 6 by the operation of the vibration table 1. In this manner, supply of dry molding sand 8 and compacting of same are repeated, as indicated by the two-dot-chain lines in Fig. 1, until the molding box 2 is filled with the dry molding sand 8 completely.

Accordingly, by the above described method of producing a mold for a full mold process, the molding box 2 is vibrated mainly upwardly and downwardly in response to vibrations of the vibration motor 3, thereby to compact the dry molding sand 8 to a desired density and to make its

further sinking or fall in level in response to the onward operation of the vibration table 1 to a negligibly small value. Then, a layer of dry molding sand 8 of another supply is formed on the already compacted layer of dry molding sand 8. The amount of molding sand 8 of another supply is determined in view of the shape and the size of the pattern 6 so as not to sink or fall in level too largely. The dry molding sand 8 of the above described "another supply" is then compacted around the pattern 6 in the similar manner as the previous supply of dry molding sand 8 by the operation of the vibration table 1. By this, the pattern 6 is subjected to a relatively small external force resulting from movement of molding sand 8 of each supply. Accordingly, even when the pattern 6 has a projection directed to intersect the axis of the molding box at right angles, it is assuredly prevented from being damaged at the projection.

Since the dry molding sand 8 is formed from a plurality of relatively thin layers, the irregularity of forces acting on a pattern can be reduced or lowered even when the pattern is asymmetrical about a longitudinal axis, thus making it possible to prevent the pattern from being bent undesiredly after completion of the mold.

Further, since the dry molding sand 8 is compacted at each layers, the amount of movement of dry molding sand 8 can be reduced considerably as compared with that in the case where the molding sand is supplied and compacted all at once, particularly when the pattern 6 has a complex configuration with complexly protruded and recessed

portions which require large movement of the dry molding sand 8, thus making it possible to effectively prevent the pattern 6 from being bent.

Experiments were conducted to produce an engine crankshaft by the method of this invention and it was found that, as shown in Fig. 3, the mold 9 produced by the method of this invention has no damage and no deformations at the projected portions of the pattern 6, even though the pattern 6 has many complexly protruded and recessed portions, and therefore does not cause the pattern 6 of itself to be bent.

Claims:

1. A method of producing a mold for a full mold process, comprising:

disposing a pattern within a molding box;

supplying dry molding sand into said molding box dividedly; and

vibrating said molding box at each divided supply of said dry molding sand.

2. A method of producing a mold for a full mold process, comprising:

disposing a pattern within a molding box;

supplying a portion of dry molding sand into said molding box;

vibrating said molding box to compact said portion of dry molding sand around said pattern; and

repeating said supplying and said vibrating alternately until said molding box is filled with said dry molding sand.

3. A method as claimed in claim 2, wherein said supplying comprising determining an amount of dry molding sand in view of the shape and the size of said pattern so that the amount of movement of said dry molding sand during said vibrating is smaller than a predetermined value.

4. A method of producing a mold, substantially as described with reference to Figures 1 to 3 of the accompanying drawings.

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